

Appendix 6-C

Coal and Rock Characteristics

AVERAGE COAL ANALYSES, HIAWATHA NE QUADRANGLE

	No. Analyses	As-received (percent)	
		Average	Range
BEAR CANYON BED			
Moisture	6	6.8	4.5-10.9
Volatile matter	6	43.8	37.4-46.0
Fixed carbon	6	45.7	44.9-46.0
Ash	6	4.5	3.8- 5.8
Sulfur	6	0.53	0.5- 0.6
Btu/lb	6	13,014	10,840-13,530
BLIND CANYON BED			
Moisture	10	4.8	3.8- 5.3
Volatile matter	9	41.7	40.2-44.7
Fixed carbon	9	44.3	39.2-48.3
Ash	10	3.9	5.8-12.4
Sulfur	8	0.58	0.5- 0.6
Btu/lb	9	12,492	11,700-13,080
HIAWATHA BED			
Moisture	370	5.6	0.7 -11.0
Volatile matter	357	42.3	36.3 -46.4
Fixed carbon	357	45.7	38.3 -52.7
Ash	359	6.2	3.3 -11.2
Sulfur	330	0.61	0.29- 1.1
Btu/lb	365	12,719	11,521-13,600

(AFTER DOELLING, 1972)

Sample No. WP-8-75U.S.G.S. Serial No. D174679Location Co-op Mine

Face channel Sample

Sec. 22, T. 16 S., R. 7 E.

Seam Bear Canyon SeamFormation BlackhawkThickness Sampled 7'Date Sampled May 8, 1975

Proximate Analysis

	AD	AR	Dry	MAF
M	4.4	6.1		
VM	45.6	44.8	47.7	50.8
FC	44.1	43.3	46.2	49.2
Ash	5.9	5.8	6.1	
Btu/lb.	13140	12910	13740	14640

Ultimate Analysis

	AD	AR	Dry	MAF
H	5.9	5.9	5.6	6.0
C	72.6	71.4	76.0	80.9
N	1.3	1.3	1.4	1.5
O	13.8	15.1	10.4	11.1
S	0.5	0.5	0.5	0.5

FORMS OF SULFUR: Sulfate Pyritic Organic

As-received	0.02	0.16	0.30
Moist.-free	0.02	0.17	0.32
M. and ash-free	0.02	0.18	0.35

Free-swelling index No. 2 1/2

TRACE ELEMENTS BY VARIOUS DETERMINATIONS (Coal as received)

As (ppm) 1 F (ppm) 420 Hg (ppm) 0.03 Sb (ppm) 0.1 Se (ppm) 1.3

TRACE ELEMENTS, MOSTLY ATOMIC ABSORPTION ON ASH

Ag % <u>2.33</u>	Cu (ppm) <u>97</u>	Zn (ppm) <u>19</u>
As % <u>2.96</u>	Li (ppm) <u>84</u>	Mn (ppm) <u>200</u>
B (ppm) <u>4</u>	Pb (ppm) <u>25</u>	

DELAYED NEUTRON DETERMINATION OF URANIUM AND THORIUM

ppm Th 5.0247 ppm U

SEMIOQUANTITATIVE 6-STEP SPECTROGRAPHIC ANALYSIS OF THE ASH

G=Greater than 10%; N=Not detected; L=Detected, but below limit of determination

Fe % <u>5.0</u>	Be (ppm) <u>N</u>	Pb (ppm) <u>30</u>	W (ppm) <u>N</u>	Bi <u>N</u>
Co % <u>1.5</u>	Pi <u>N</u>	Pd <u>N</u>	Y <u>30</u>	Cl <u>N</u>
Ca % <u>6</u>	Cd <u>N</u>	Pt <u>N</u>	Zn <u>N</u>	Br <u>N</u>
Ti % <u>0.3</u>	Co <u>10</u>	Sb <u>N</u>	Zr <u>200</u>	Te <u>N</u>
Si % <u>---</u>	Cr <u>70</u>	Sc <u>15</u>	Ce <u>N</u>	Se <u>3</u>
Mn (ppm) <u>150</u>	Cu <u>70</u>	Sn <u>N</u>	Ga <u>20</u>	As <u>N</u>
As (ppm) <u>N</u>	La (ppm) <u>N</u>	Sr (ppm) <u>500</u>	Ge (ppm) <u>20</u>	Al % <u>7.0</u>
Al <u>N</u>	Mo <u>15</u>	Te <u>N</u>	Hf <u>N</u>	Ni % <u>---</u>
C <u>1500</u>	Nb <u>L20</u>	U <u>N</u>	In <u>N</u>	K % <u>N</u>
Ba <u>1500</u>	Ni <u>20</u>	V <u>70</u>	Li <u>N</u>	S % <u>N</u>

LOOKED FOR ONLY WHEN La OR Ce FOUND:

Fe	Fusibility of ash temp. °F.
Mo	Initial Deform. -----2190
Si	Softening -----2250
Eu	Fluid -----2300

% Ash determined gravimetrically ashed at 525° C. -6.8%

Ash
Composition

AL2O3	-----11.0%
SiO2	----- 7.9% 8.4%
CL	-----0.10%
CaO	-----24.0%
SiO2	----- 25.0% 24.0%
P2O5	-----0.74%
TiO2	-----0.71%
MnO	-----40.020%
FE2O3	-----7.6%
K2O	-----0.17%

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 AREA CODE 312 726-8434

WESTERN DIVISION MANAGER
LLOYD W. TAYLOR, JR.PLEASE ADDRESS ALL CORRESPONDENCE TO:
10775 EAST 51st AVE., DENVER, COLO. 80239
OFFICE TEL. (303) 373-4772CO-OP MINING COMPANY
Box No. 300
Huntington, Utah 84528

June 25, 1979

Sample identification
by

Kind of sample reported to us	Floor Rock	CO-OP Mining Co.
Sample taken at	XXXXXX	Sample No. 57-2162 (CT&E Helper)
Sample taken by	CO-OP Mining Co.	CO-OP Mine No. 2
Date sampled	XXXXXX	Huntington Canyon
Date received	5-24-79	

Analysis report no. 72-82660

SOIL ANALYSIS

pH	8.4
Sodium	5.4
Calcium	.61
Mangesium	4.4
Sodium Adsorption Ratio	6.4
Pyrite (as S-CaCO ₃ eq t/1000T	0.0
Sand %	65
Silt %	26
Clay %	9

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

G. D. PALMER, Manager, Denver Laboratory



Charter Member

GDP/vt

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WESTERN DIVISION MANAGER
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10775 EAST 51st AVE., DENVER, COLO. 80239
OFFICE TEL. (303) 373-4772CO-OP MINING COMPANY
Box No. 300
Huntington, Utah

June 25, 1979

Sample identification
by

Kind of sample reported to us	Roof Rock	CO-OP Mining Co.
Sample taken at	xxxxxx	Sample No. 57-2163 (CT&E Helper)
Sample taken by	CO-OP Mining Co.	CO-OP Mine No. 2
Date sampled	xxxxxx	Huntington Canyon
Date received	5-24-79	

Analysis report no. 72-82661

SOIL ANALYSIS

pH	8.7
Sodium	12.5
Calcium	.34
Magnesium	.76
Sodium Adsorption Ratio	16.9
Pyrite (as S-CaCO ₃ eq t/1000T)	0.0
Sand %	
Silt %	
Clay %	

Respectfully submitted,
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G. D. PALMER, Manager, Denver Laboratory



Charter Member

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GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 AREA CODE 312 726-4434

EASTERN DIVISION MANAGER

WILLIAM D. PALMER



PLEASE ADDRESS ALL CORRESPONDENCE TO

224 South Carbon Avenue

Price, Utah 84501

Phone: (801) 637-7540

March 2, 1982

CO-OP MINING CO

P.O. Box 300

Huntington, Utah 84528

Company Identification

Co-op Mining Co.

#2

Kind of sample
reported to us

Coal

Sample taken at

xxxx

Sample taken by

Co-op Mining Co.

Date sampled

xxxx

Date received

2-25-82

Analysis report no. 57-2990

SHORT PROXIMATE ANALYSIS

As Received Dry Basis

% Moisture	4.70	xxxx
% Ash	7.49	7.86
Btu/lb	12937	13575
% Sulfur	0.41	0.43

% Air Dry Loss = 3.07

Moisture, Ash-free Btu = 14733

Pounds of SO₂ per 10⁶ Btu = 0.63

Moist, Mineral matter free Btu * = 14088

(Based on as rec'd moisture)*

Pounds of Sulfur per 10⁶ Btu = 0.32

JB/ct

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Jack Blair

JACK D. BLAIR, Manager, Price Laboratory

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JAVE BALOON
MANAGER
SOUTHWEST DIVISION



PLEASE ADDRESS ALL CORRESPONDENCE TO:
224 S. CARBON AVE., PRICE, UT 84501
OFFICE TEL. (801) 637-7540

CO-OP MINING COMPANY
P.O. Box 300
Huntington, Utah 84528

November 10, 1983

Sample identification
by

CO-OP Mining

Kind of sample
reported to us Coal

Bear Canyon
Hiawatha Seam

Sample taken at Bear Canyon

Sample taken by Co-op Mining Co.

Date sampled xxxxx

Date received 11-4-83

Analysis report no.57-14270

SHORT PROXIMATE ANALYSIS

As Received Dry Basis

% Moisture	7.95	xxxxx
% Ash	9.55	10.37
Btu/lb	11641	12646
% Sulfur	0.50	0.54

% Air Dry Loss = 5.03
Moisture, Ash-free Btu = 14109
Pounds of SO₂ per 10⁶ Btu = 0.85
Moist, Mineral matter free Btu * = 12992
(Based on as rec'd moisture)*
Pounds of Sulfur per 10⁶ Btu = 0.43
% Residual moisture = 3.07

JB/cj

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

John Blair

Manager, Price Laboratory

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Charter Member

OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS,
TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES



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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 26, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Co-op
North Bottom
1 bag
13.25 lbs.
(amended results)

Sample: CS-2B

Analysis report no. 59-100972

SOIL ANALYSIS

pH	7.5 units	
Electrical conductivity	2700 umhos/cm	(2.7 mmhos/cm)
Saturation percent	47.2	
Soluble calcium	10.62 meq/l	
Soluble magnesium	3.06 meq/l	
Soluble sodium	0.83 meq/l	
Sodium adsorption ratio	0.31	
Exchangeable sodium percent	<0.01	
Total nitrogen	1.28 %	
Nitrate-nitrogen	0.42 mg/kg	
Organic carbon	67.48 %	
Boron	<0.01 mg/kg	
Selenium, total available	<0.1 ppm	
Available water capacity	4.94 %	

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

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Manager, Huntington Laboratory

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CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 26, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Co-op
North Bottom
1 bag
13.25 lbs.
(amended results)

Sample: CS-2B

Analysis report no. 59-100972

SOIL ANALYSIS

Max. acid potential 21.6 tons CaCO_3 /1000 tons
Neutralization potential 36.2 tons CaCO_3 /1000 tons

(acid potential based on total sulfur of 0.69%; pyritic sulfur of .14% would yield an acid potential of 4.4)

Coarse fragments 69.6 %

Particle size analysis:

Sand 88.4 %
Silt 7.6 %
Clay 4.0 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 31, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Co-op

North-west Top

Sample taken at

Co-op

1 bag

Sample taken by

Co-op

12.0 lbs.

(amended results)

Date sampled

Date received

May 3, 1989

Sample: CS-1T

Analysis report no. 59-100973

SOIL ANALYSIS

pH	7.5	units
Electrical conductivity	1200	umhos/cm (1.2 mmhos/cm)
Saturation percent	46.4	
Soluble calcium	2.32	meq/l
Soluble magnesium	0.81	meq/l
Soluble sodium	1.08	meq/l
Sodium adsorption ratio	0.86	
Exchangeable sodium percent	0.01	
Total nitrogen	1.35	%
Nitrate-nitrogen	0.28	mg/kg
Organic carbon	75.44	%
Boron	0.19	mg/kg
Selenium, total available	<0.1	ppm
Available water capacity	4.32	%

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 31, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Co-op
North-west Top
1 bag
12.0 lbs.
(amended results)

Sample: CS-1T

Analysis report no. 59-100973

SOIL ANALYSIS

Max. acid potential 17.2 tons CaCO_3 /1000 tons
Neutralization potential 13.8 tons CaCO_3 /1000 tons

(acid potential based on total sulfur of 0.55%; pyritic sulfur of .10% would yield an acid potential of 3.1)

Coarse fragments 97.7 %

Particle size analysis:

Sand	90.4 %
Silt	3.6 %
Clay	6.0 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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TELEPHONE: (801) 653-2311

CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 31, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Co-op
North-west Middle
1 bag
13.75 lbs.
(amended results)

Sample: CS-1M

Analysis report no. 59-100974

SOIL ANALYSIS

pH	7.6 units	
Electrical conductivity	900 umhos/cm	(0.9 mmhos/cm)
Saturation percent	48.9	
Soluble calcium	1.90 meq/l	
Soluble magnesium	0.97 meq/l	
Soluble sodium	1.10 meq/l	
Sodium adsorption ratio	0.92	
Exchangeable sodium percent	0.09	
Total nitrogen	1.26 %	
Nitrate-nitrogen	0.24 mg/kg	
Organic carbon	72.58 %	
Boron	0.11 mg/kg	
Selenium, total available	<0.1 ppm	
Available water capacity	4.7 %	

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

W W
Manager, Huntington Laboratory

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CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 31, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Co-op
North-west Middle
1 bag
13.75 lbs.
(amended results)

Sample: CS-1M

Analysis report no. 59-100974

SOIL ANALYSIS

pH	7.6 units	
Electrical conductivity	900 umhos/cm	(0.9 mmhos/cm)
Saturation percent	48.9	
Soluble calcium	1.90 meq/l	
Soluble magnesium	0.97 meq/l	
Soluble sodium	1.10 meq/l	
Sodium adsorption ratio	0.92	
Exchangeable sodium percent	0.09	
Total nitrogen	1.26 %	
Nitrate-nitrogen	0.24 mg/kg	
Organic carbon	72.58 %	
Boron	0.11 mg/kg	
Selenium, total available	<0.1 ppm	
Available water capacity	4.7 %	

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

W W
Manager, Huntington Laboratory

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TELEPHONE: (801) 653-2311

CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 31, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Co-op

North-west Middle

Sample taken at

Co-op

1 bag

13.75 lbs.

Sample taken by

Co-op

(amended results)

Date sampled

Date received

May 3, 1989

Sample: CS-1M

Analysis report no. 59-100974

SOIL ANALYSIS

Max. acid potential

22.2 tons CaCO_3 /1000 tons

Neutralization potential

13.8 tons CaCO_3 /1000 tons

(acid potential based on total sulfur of 0.71; pyritic sulfur of .21 would yield an acid potential of 6.6)

Coarse fragments

94.5 %

Particle size analysis:

Sand

89.5 %

Silt

8.5 %

Clay

2.0 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.


Manager, Huntington Laboratory

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CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 31, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Co-op
North-west Bottom
1 bag
15.25 lbs.
(amended results)

Sample: CS-1B

Analysis report no. 59-100975

SOIL ANALYSIS

pH	7.4 units
Electrical conductivity	2600 umhos/cm (2.6 mmhos/cm)
Saturation percent	48.3
Soluble calcium	9.54 meq/l
Soluble magnesium	3.20 meq/l
Soluble sodium	1.08 meq/l
Sodium adsorption ratio	0.43
Exchangeable sodium percent	<0.01
Total nitrogen	1.23 %
Nitrate-nitrogen	0.16 mg/kg
Organic carbon	67.73 %
Boron	0.18 mg/kg
Selenium, total available	<0.1 ppm
Available water capacity	5.49 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

u u
Manager, Huntington Laboratory

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CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 31, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Co-op
North-west Bottom
1 bag
15.25 lbs.
(amended results)

Sample: CS-1B

Analysis report no. 59-100975

SOIL ANALYSIS

Max. acid potential 23.1 tons CaCO_3 /1000 tons
Neutralization potential 30.0 tons CaCO_3 /1000 tons

(acid potential based on total sulfur of .74%; pyritic sulfur of .23% would yield an acid potential of 7.2)

Coarse fragments 77.4 %

Particle size analysis:

Sand	91.3 %
Silt	2.7 %
Clay	6.0 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.


Manager, Huntington Laboratory

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Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TELEPHONE: (801) 653-2311

CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 26, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Co-op

North Top

Sample taken at

Co-op

1 bag

Sample taken by

Co-op

16.0 lbs.

(amended results)

Date sampled

Date received

May 3, 1989

Sample: CS-2T

Analysis report no. 59-100970

SOIL ANALYSIS

pH	8.0 units
Electrical conductivity	600 umhos/cm (0.6 mmhos/cm)
Saturation percent	48.0
Soluble calcium	0.65 meq/l
Soluble magnesium	0.61 meq/l
Soluble sodium	1.70 meq/l
Sodium adsorption ratio	2.14
Exchangeable sodium percent	1.86
Total nitrogen	1.42 %
Nitrate-nitrogen	0.17 mg/kg
Organic carbon	73.57 %
Boron	0.07 mg/kg
Selenium, total available	<0.1 ppm
Available water capacity	4.65 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

W M
Manager, Huntington Laboratory

OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS,
TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES



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1 bag

Sample taken by

Co-op

16.0 lbs.

(amended results)

Date sampled

Date received

May 3, 1989

Sample: CS-2T

Analysis report no. 59-100970

SOIL ANALYSIS

Max. acid potential

19.1 tons CaCO_3 /1000 tons

Neutralization potential

5.0 tons CaCO_3 /1000 tons

(Acid potential based on total sulfur of 0.61% - pyritic
sulfur would yield an acid potential of 2.2)

Coarse fragments

98.4 %

Particle size analysis:

Sand

97.1 %

Silt

1.9 %

Clay

1.0 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Huntington Laboratory

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TELEPHONE: (801) 653-2311

CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 26, 1989

Sample identification
by

Co-op

Kind of sample
reported to us

COAL

Co-op
North Middle
1 bag
12.5 lbs.
(amended results)

Sample taken at

Co-op

Sample taken by

Co-op

Date sampled

Date received

May 3, 1989

Sample: CS-2M

Analysis report no. 59-100971

SOIL ANALYSIS

pH	7.8	units
Electrical conductivity	580	umhos/cm (0.58 mmhos/cm)
Saturation percent	47.8	
Soluble calcium	0.60	meq/l
Soluble magnesium	0.36	meq/l
Soluble sodium	0.72	meq/l
Sodium adsorption ratio	1.04	
Exchangeable sodium percent	0.26	
Total nitrogen	1.36	%
Nitrate-nitrogen	0.06	mg/kg
Organic carbon	71.88	%
Boron	0.11	mg/kg
Selenium, total available	<0.1	ppm
Available water capacity	4.67	%

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

W. C. Y.
Manager, Huntington Laboratory

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TELEPHONE: (801) 853-2311

CO-OP MINE
P.O. Box 300
Huntington, UT 84528

July 26, 1989

Sample identification
by Co-op

Kind of sample reported to us COAL
Sample taken at Co-op
Sample taken by Co-op

Co-op
North Middle
1 bag
12.5 lbs.
(amended results)

Date sampled

Date received May 3, 1989

Sample: CS-2M

Analysis report no. 59-100971

SOIL ANALYSIS

Max. acid potential 20.6 tons CaCO_3 /1000 tons
Neutralization potential 11.2 tons CaCO_3 /1000 tons

(acid potential based on total sulfur of 0.66%; pyritic sulfur of .11% would yield an acid potential of 3.4)

Coarse fragments 94.1 %

Particle size analysis:

Sand	90.4 %
Silt	7.6 %
Clay	2.0 %

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

W. W.
Manager, Huntington Laboratory

OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS,
TIDEWATER AND GREAT LAKES PORTS, AND RIVER LOADING FACILITIES



Inter-Mountain Laboratories, Inc.

Farmington, New Mexico 87401

Tel. (505) 326-4737

2506 West Main Street

CO-OP MINING COMPANY
HUNNINGTON, UTAH
Mine: BEAR CANYON MINE

June 8, 1989

Page 1 of 3

Lab No.	Location	Depth	pH	EC mmhos/cm @ 25C	Satur- ation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	Sand %	Silt %	Clay %	Texture
2231	COAL SAMPLE	0.0-0.0	7.5	1.03	63.8	4.94	3.36	1.15	0.56	94.5	3.7	1.8	SAND
2232	ROOF ROCK	0.0-0.0	8.1	0.84	25.1	2.80	3.67	1.95	1.08	90.4	9.4	0.2	SAND
2233	FLOOR ROCK	0.0-0.0	7.8	0.72	24.5	3.44	2.28	1.24	0.73	84.5	14.0	1.5	LOAMY SAND



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CO-OP MINING COMPANY
BLANCKENHORN, UTAH
Mine: BEAR CANYON MINE

June 8, 1989

Page 2 of 3

Lab No.	Location	Depth	Carbonate %	Total Sulfur %	I.S. AB (/1000)	Neut. Pot. (/1000)	I.S. ABP (/1000)	Pyritic Sulfur %	Organic Sulfur %	Nitrate- Nitrogen ppm	Baron ppm	Selenium ppm
2231	COAL SAMPLE	0.0-0.0	1.2	0.90	25.0	11.7	-13.3	<0.01	0.60	1.42	0.31	0.06
2232	ROOF ROCK	0.0-0.0	< 0.1	0.04	1.25	504.	503.	<0.01	0.04	1.51	0.44	0.02
2233	FLOOR ROCK	0.0-0.0	0.5	0.16	5.09	8.41	3.41	0.07	0.09	1.37	0.31	<0.02

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, PyrOrg= Pyritic Sulfur + Organic Sulfur,
Neut. Pot.= Neutralization Potential



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Farmington, New Mexico 87401

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2508 West Main Street

CO-OP MINING COMPANY
HUNNINGTON, UTAH
Mine: BEAR CANYON MINE

June 5, 1988

Page 3 of 3

Lab No.	Location	Depth	Avail Na meq/100g	Exch Na meq/100g	Total Kjeldahl Nitrogen %	Pot Acidity 1/100cc	1/3 bar	1 bar	15 bar	Organic Carbon (%)
2231	COAL SAMPLE	0.0-3.0	78.0	77.9	0.78	-0.01	13.4		8.9	Coal
2232	ROOF ROCK	0.0-0.0	87.0	87.0	0.07	-0.01	4.9		3.5	7.67
2233	FLOOR ROCK	0.0-0.0	59.0	59.0	0.35	2.19	7.2		4.2	6.44

MATERIAL PROPERTIES

Rock mass, or the overburden at Bear Canyon Mine site consists predominantly of sandstone with intermittent layers of shale and siltstone. Material properties obtained from laboratory tests on cores obtained from holes (East-B, 3-West, and North-Main) drilled into the mine roof are given in Table 1. These material properties are well within the range of properties typically obtained and reported for the corresponding general class of rocks.

Table 1: Mechanical Properties from Core Testing.

Rock Type	Compressive Strength (psi)	Young's Modulus (psi)	Poisson's Ratio
Coal	2,000 to 3,000	4×10^5 to 4.5×10^5	.3 to .4
Shale	15,000 to 17,000	3×10^6 to 4×10^6	.2 to .4
Sandstone	7,000 to 12,000	3×10^6 to 4×10^6	.3 to .4

It is well established that, for realistic analysis of stresses and deformations in coal mines, rock mass, coal, and the gob material properties must be properly adjusted to account for the non-linear behavior caused by phenomena such as weakening due to immediate roof caving, pillar yielding, and gob compaction (Kripakov et al., 1988).

Based on a composite stratigraphy, compressive strength of individual layers given above, drill core quality, and water infusion, the overall rock mass was assigned a Rock Mass Rating (RMR) of 52 corresponding to the classification "Fair" (Bieniawski, 1974). Table 2 shows the geomechanics classification of rock mass based on RMR. A visual inspection of the mine suggests that the rock mass quality in general is good and the classification as fair may be treated on the conservative side.

Table 2: Geomechanics Classification of Rock Masses.

Class	Description of Rock Mass	RMR - Cumulative Rating Increments
I	Very good rock	81-100
II	Good rock	61-80
III	Fair rock	41-60
IV	Poor rock	21-40
V	Very poor rock	0-20

Reference: Sinha, Krishna P., Ph.D., TerraTek, Inc., Mathematical Simulations to Evaluate Mining and Roof Control Plan at the Bear Canyon Mine, TR93-09, August, 1992.



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Farmington, New Mexico 87401

Tel. (505) 326-4737

CO-OP MINING CO.
Huntington, Utah

LOCATION: Bear Canyon #2 Mine

DATE SAMPLED: September 7, 1995

DATE REPORTED: October 17, 1995

Page 1 of 3

Lab No.	Location	Depths	pH	EC mmhos/cm @ 25°C	Satur- ation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	Coarse Fragments %	Sand %	Silt %	Clay %	Texture
42314	RFM 4:Roof		7.5	1.10	25.0	5.40	4.49	1.26	0.57	66.4	73.8	20.0	6.2	SANDY LOAM
42315	RFM 4:Coal		7.3	1.60	74.2	13.4	4.14	0.96	0.32	79.8	81.2	16.3	2.5	LOAMY SAND
42316	RFM 4:Floor		7.8	0.97	27.2	5.01	4.28	0.87	0.40	78.9	46.2	38.8	15.0	LOAM



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CO-OP MINING CO.
Huntington, Utah

DATE SAMPLED: September 7, 1995
DATE REPORTED: October 17, 1995

LOCATION: Bear Canyon #2 Mine

Page 2 of 3

Lab No.	Location	Depths	Organic Matter %	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	PyrS AB t/1000t	PyrS ABP t/1000t
42314	RFM 4:Roof		11.6	0.02	0.70	423.	422.	<0.01	0.03	0.03	0.98	422.
42315	RFM 4:Coal		24.6	0.72	22.4	9.03	-13.3	0.03	0.11	0.58	3.50	5.53
42316	RFM 4:Floor		23.1	0.05	1.56	363.	362.	<0.01	0.10	0.06	3.21	360.

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential

JB



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Farmington, New Mexico 87401

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CO-OP MINING CO.
Huntington, Utah

DATE SAMPLED: September 7, 1995
DATE REPORTED: October 17, 1995

LOCATION: Bear Canyon #2 Mine

Page 3 of 3

Lab No.	Location	Depths	Nitrate-Nitrogen ppm	Boron ppm	Bulk Density	Total Kjeldahl Nitrogen %	1/3 bar	15 bar	H2O Sol Selenium ppm
42314	RFM 4:Roof		<0.01	0.04		0.03	11.1	1.5	<0.02
42315	RFM 4:Coal		<0.01	0.13		1.31	11.5	6.2	<0.02
42316	RFM 4:Floor		<0.01	0.12		0.13	9.2	3.2	<0.02

JB

Soil Analysis Report

C.W. Mining Company

Bear Canyon Mine

P.O. Box 1245

Huntington, UT 84528

Page 1 of 3

Client Project ID: Bear Canyon Mine

Date Received: 09/30/02

Set #0103S00365

Report Date: 01/14/03

Lab Id	Sample Id	pH	Saturation	EC @ 25°C	Calcium	Magnesium	Sodium	Potassium	SAR
		s u.	%	mmhos/cm	meq/L	meq/L	meq/L	meq/L	
0103S00365	RFM-1 Floor	8.3	28.6	1.64	3.36	10.4	4.01	0.57	1.53
0103S00366	RFM-1 Coal	3.7	73.1	1.27	1.47	3.67	4.81	0.31	3.00
0103S00367	RFM-1 Ceiling	8.2	27.4	2.39	4.55	17.8	6.29	0.89	1.88
0103S00368	Sed Pond A	8.3	39.0	3.15	14.9	14.9	6.71	0.52	1.74

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By:

Joey Sheeley, Soils Lab Supervisor

01/13/03

6C-26

BC

Soil Analysis Report
C.W. Mining Company
Bear Canyon Mine
P.O. Box 1245
Huntington, UT 84528

Page 2 of 3

Client Project ID: Bear Canyon Mine
Date Received: 09/30/02Set #0103S00365
Report Date: 01/14/03

Lab Id	Sample Id	Very Fine	Sand	Silt	Clay	Texture	CO3	Organic	Alkalinity
		Sand						Matter	PE
		%	%	%	%		%	%	meq/L
0103S00365	RFM-1 Floor	18.9	74.0	18.0	8.0	SANDY LOAM	45.8	0.2	2.20
0103S00366	RFM-1 Coal	<0.1	92.0	6.0	2.0	SAND	<0.5	32.3	8.56
0103S00367	RFM-1 Ceiling	8.0	54.0	32.0	14.0	SANDY LOAM	66.9	0.2	1.40
0103S00368	Sed Pond A	13.2	76.0	14.0	10.0	SANDY LOAM	12.8	1.1	0.80

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By:

Joey Sheeley, Soils Lab Supervisor

6C-27

BC

Soil Analysis Report
C.W. Mining Company
Bear Canyon Mine
P.O. Box 1245
Huntington, UT 84528

Page 3 of 3

Client Project ID: Bear Canyon Mine
Date Received: 09/30/02Set #0103S00365
Report Date: 01/14/03

Lab Id	Sample Id	TOC %	Total Sulfur %	Neutral. Pot. 1/10001	Boron PE ppm	Nitrogen Nitrate meq/L	Phosphorus mg/Kg	Selenium ppm
0103S00365	RFM-1 Floor	0.1	<0.01	470	0.17	0.66	2.00	<0.02
0103S00366	RFM-1 Coal	18.8	0.44	-2.55	10.6	12.3	4.90	<0.02
0103S00367	RFM-1 Ceiling	0.1	<0.01	691	0.52	0.92	1.70	<0.02
0103S00368	Sed Pond A	0.6	0.29	127	0.86	0.69	3.60	<0.02

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By:

Joey Sheeley, Soils Lab Supervisor

01/13/03

6C-28

BC